

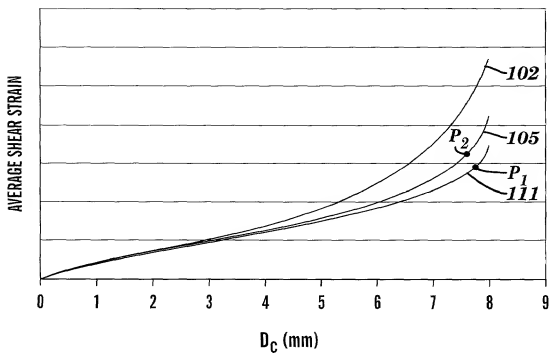
FIG. 1

SOLDER BALL THERMAL CYCLING FATIGUE TEST DATA

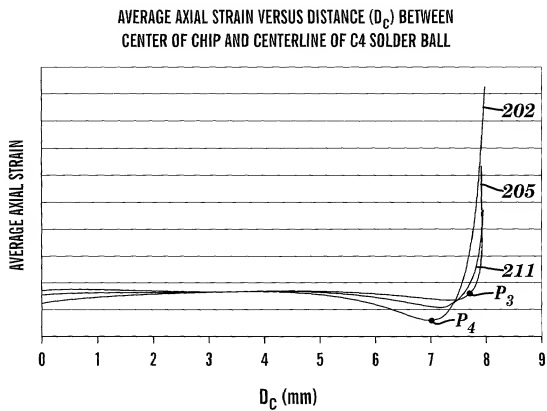
ROW	SAMPLE SIZE	CHIP SIZE (mm x mm)	ORGANIC SUBSTRATE PAD DIAMETER, D2 (mm)	CHIP PAD DIAMETER, D1 (mm)	D1/D2	S1/S2	SOLDER BALL HEIGHT ( $\mu$ m)	DISTANCE (D <sub>EDGE</sub> ) FROM SOLDER BALL CENTERLINE TO CHIP EDGE ( $\mu$ m)	NO. OF CYCLES TO 50% FAILS	FIRST CYCLE TO FAIL
1	47	8.7 x 8.7	160	140	0.88	0.77	110	230	13260	2500
2	30	8.7 x 8.7	155	140	0.90	0.81	110	100	8430	2500
3	19	8.7 x 8.7	160	140	0.88	0.77	110	100	7963	2500
4	75	7.68 x 7.68	160	100	0.63	0.40	100	100	3250	600

**FIG. 2**

AVERAGE SHEAR STRAIN VERSUS DISTANCE ( $D_C$ ) BETWEEN  
CENTER OF CHIP AND CENTERLINE OF C4 SOLDER BALL



**FIG. 3**



**FIG. 4**